WATER SUPPLY OUTLOOK FOR WESTERN UNITED STATES

Including Columbia River Drainage in Canada

and

FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
Collaborating with
CALIFORNIA DEPARTMENT of WATER RESOURCES
and
BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES

AS OF
MAR. 1, 1967

TO RECIPIENTS OF WATER SUPPLY OUTLOOK REPORTS:

Most of the usable water in western states originates as mountain snowfall. This snowfall accumulates during the winter and spring, several months before the snow melts and appears as streamflow. Since the runoff from precipitation as snow is delayed, estimates of snowmelt runoff can be made well in advance of its occurrence. Streamflow forecasts published in this report are based principally on measurement of the water equivalent of the mountain snowpack.

Forecasts become more accurate as more of the data affecting runoff are measured. All forecasts assume that climatic factors during the remainder of the snow accumulation and melt season as they affect runoff will add to be an effective average. Early season forecasts are therefore subject to a greater change than those made on later dates.

The snow course measurement is obtained by sampling snow depth and water equivalent at surveyed and marked locations in mountain areas. A total of about ten samples are taken at each location. The average of these are reported as snow depth and water equivalent. These measurements are repeated in the same location near the same dates each year.

Snow surveys are made monthly or semi-monthly from January 1 through June 1 in most states. There are about 1400 snow courses in Western United States and in the Columbia Basin in British Columbia. In the near future, it is anticipated that automatic snow water equivalent sensing devices along with radio telemetry will provide a continuous record of snow water equivalent at key locations.

Detailed data on snow course and soil moisture measurements are presented in state and local reports. Other data or reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. The report for Western United States presents a broad picture of water supply outlook conditions, including selected streamflow forecasts, summary of snow accumulation to date, and storage in larger reservoirs.

Snow survey and soil moisture data for the period of record are published by the Soil Conservation Service by states about every five years. Data for the current year is summarized in a West-wide basic data summary and published about October 1 of each year.

Listed below are water supply outlook reports based on Federal-State-Private Cooperative snow surveys. Those published by the Soil Conservation Service may be obtained from Soil Conservation Service, Room 507, Federal Building, 701 N. W. Glisan, Portland, Oregon 97209.

PUBLISHED BY SOIL CONSERVATION SERVICE

D. A. WILLIAMS, Administrator

The Soil Conservation Service publishes reports following the principal snow survey dates from January 1 through June 1 in cooperation with state water administrators, agricultural experiment stations and others. Copies of the reports for Western United States and all state reports may be obtained from Soil Conservation Service, Western Regional Technical Service Center, Room 507, 701 N. W. Glisan, Portland, Oregon 97209.

Copies of state and local reports may also be obtained from state offices of the Soil Conservation Service in the following states:

STATE	ADDRESS
Alaska	P. O. Box "F", Palmer, Alaska 99645
Arizona	6029 Federal Building, Phoenix, Arizona 85205
Colorado (N. Mex.)	12417 Federal Building, Denver, Colorado 80202
Idaho	P. O. Box 38, Boise, Idaho 83701
Montana	P. O. Box 855, Bozeman, Montana 59715
Nevada	P. O. Box 4850, Reno Nevada 89505
Oregon	1218 S. W. Washington St., Partland, Oregon 97205
Utah	4001 Federal Building, Salt Lake City, Utah 84111
Washington	840 Bon Marche Bldg., Spokane, Washington 99206
Wyoming	P. O. Box 340, Casper, Wyoming 82602

PUBLISHED BY OTHER AGENCIES

Water Supply Outlook reports prepared by other agencies include a report for California by the Water Supply Forecast and Snow Surveys Unit, Califarnia Department of Water Resources, P. O. Box 388, Sacramento, California 95802 --- and for British Columbia by the Department of Lands, Farests and Water Resources, Water Resources Service, Parliament Building, Victoria, British Columbia

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WATER SUPPLY OUTLOOK
and
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for
WESTERN UNITED STATES
Including Columbia River Drainage in Canada

ISSUED

MARCH 1, 1967

The Soil Conservation Service coordinates snow surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Weather Bureau, Geological Survey, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

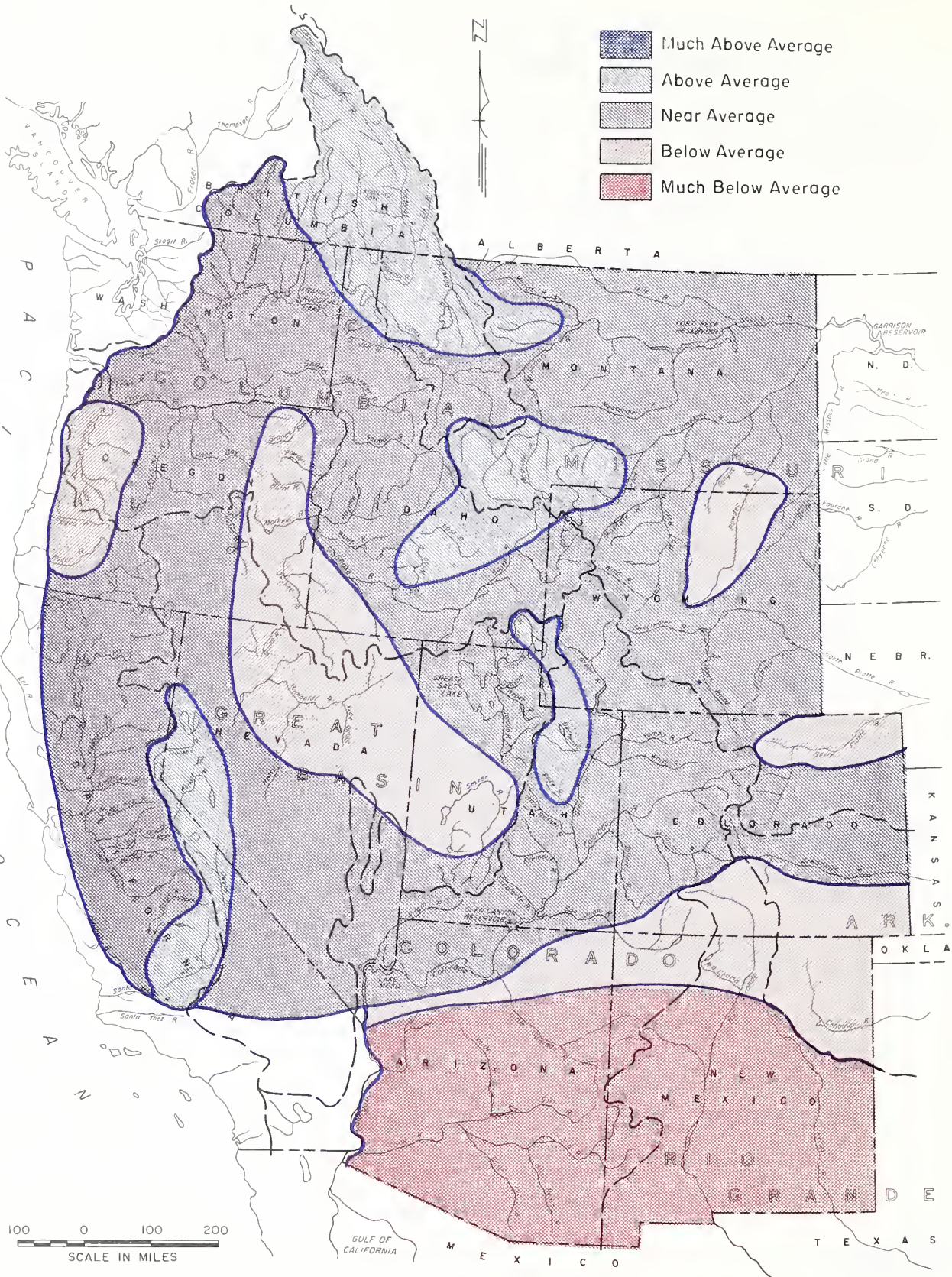
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report was prepared by the Water Supply Forecasting Branch, Engineering Division, Soil Conservation Service, from data supplied by Snow Survey Supervisors of the Soil Conservation Service in the States of Alaska, Arizona, Colorado and New Mexico, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

Data from California was supplied by the Chief, Water Supply Forecast and Snow Survey Unit, Department of Water Resources.

Data from British Columbia was supplied by the Chief, Hydrology Division, Water Investigations Branch, Department of Lands, Forests and Water Resources.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
D. A. WILLIAMS, ADMINISTRATOR



1967 SNOWMELT SEASON

PROSPECTIVE STREAMFLOW

AS OF MARCH 1, 1967

WATER SUPPLY OUTLOOK
As of March 1, 1967

WATER SUPPLY OUTLOOK FOR 1967 IS FOR ADEQUATE WATER SUPPLIES FOR MOST AREAS. MUCH LESS THAN AVERAGE STREAMFLOW IS IN PROSPECT FOR THE RIO GRANDE AND LOWER COLORADO RIVER TRIBUTARIES IN ARIZONA. OTHER SMALL AREAS MAY HAVE SHORTAGES IF THE DRY TREND CONTINUES.

As of March 1, the mountain snowpack along with carryover storage indicates that irrigation water supplies will be reasonably adequate for 1967. Snow accumulation during February has been less than average over most of the west, much less than average in California, Arizona and New Mexico. This has reduced streamflow prospects in varying amounts from a month ago.

Some deficiency in streamflow from snowmelt is still expected east of the Continental Divide in Colorado, particularly on the Rio Grande. On the lower Rio Grande in New Mexico and the lower Colorado River tributaries in Arizona, streamflow will be among the lowest of record as far as snowmelt runoff is concerned. Less than average streamflow, to the extent that some shortage may be expected, is in prospect for parts of the Great Basin in Utah and Nevada. The Central Arizona area has much above average carryover storage which will alleviate the streamflow shortage for areas with storage.

In contrast, the flow of the Columbia River in Canada is expected to equal the maximum flow in the past 25 years.

The California Department of Water Resources reports that, with a dearth of precipitation throughout the State during February, factors effecting water conditions in the State have normalized. Although precipitation was almost nonexistent on all major watersheds during the past month, snowpack accumulation is still slightly above normal for March 1. Also, runoff to date and storage in California's major reservoirs are slightly above normal. Therefore, with normal precipitation for the remainder of the season, the outlook is for near normal water supplies for all major water use areas of the State.

SNOWPACK

While snowpack over most mountain areas is near average, there are some unusual extremes. On the headwaters of the Columbia and Kootenai rivers in Canada, many snow courses have water contents equal to or exceeding any previous measurements based on records extending back as much as 25 years. A similar snowpack situation exists on the Kootenai and Flathead in Montana. Another area of heavy mountain snowpack is the east slope of the Sierras in California.

In contrast there is practically no snow in mountain areas of Arizona. Most snow courses are bare with snow at the highest elevations only one-quarter of average for this date. The Rio Grande watershed also has a very low snowpack except for high elevations along the Continental Divide in Colorado.

In all areas there is a definite tendency for the heavier snowpacks to be concentrated at the higher mountain elevations. This reflects the fact that temperatures have tended to be above average during the winter months.

STORAGE

Even with heavy demands and relatively low streamflow in 1966, carryover storage remains near average for most irrigated areas. Exceptions are the central valley of Arizona where storage is well above average and the Rio Grande of New Mexico where storage is low with respect to average as well as to total capacity. Except for Arizona, California and Washington, carryover storage for 1967 is much less than for a year ago when the storage picture was extremely favorable. Major reservoirs on both the Missouri and Colorado Rivers have substantial unfilled capacity.

STREAMFLOW FORECASTS

The Columbia at The Dalles, Oregon and the Missouri at Williston, North Dakota are expected to have flows about ten percent in excess of average in 1967. This is twenty to thirty percent higher than for last year. Inflow to Lake Powell on the Colorado River is expected to be near average and roughly 130 percent of that for 1966. As indicated by the present snowpack, total seasonal flow of the Columbia in Canada will be near the highest flow of record for the past 25 years, comparable to 1954 in this watershed. Flows along the lower river will be relatively less because inflow of tributary streams in the United States will be average or less than average.

Forecasts for California Central Valley

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS MARCH 1, 1967

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
MISSOURI BASIN		
Jefferson	150	110
Madison	170	125
Gallatin	175	130
Missouri Main Stem	170	130
Yellowstone	175	130
Shoshone	130	100
Wind	145	100
North Platte	145	110
South Platte	135	85
ARKANSAS BASIN		
Arkansas	120	90
Canadian	65	55
RIO GRANDE BASIN		
Rio Grande (Colo.)	85	90
Rio Grande abv. Otowi Bridge	60	70
Pecos	40	60
COLORADO BASIN		
Green (Wyo.)	130	105
Yampa - White	135	105
Duchesne	125	115
Price	120	100
Upper Colorado	130	105
Gunnison	110	95
San Juan	80	90
Dolores	100	110
Virgin	60	85
Gila	3	6
Salt	4	7
GREAT BASIN		
Bear	127	102
Logan	122	102
Ogden	89	92
Weber	118	98
Provo - Utah Lake	123	107
Jordan	123	96
Sevier	78	77
Walker - Carson	120	119
Tahoe - Truckee	121	115
Humboldt	109	83
Lake Co. (Oregon)	108	96
Harney Basin (Oregon)	106	80
UPPER COLUMBIA BASIN		
Columbia (Canada)	130	140
Kootenai	125	130
Clark Fork	135	110
Bitterroot	150	105
Flathead	145	130
Spokane	119	91
Okanogan	124	117
Methow	121	105
Chelan	119	109
Wenatchee	80	93

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
SNAKE BASIN		
Snake above Jackson, Wyo.	130	104
Snake above Hiese, Idaho	140	105
Snake abv. American Falls Res.	150	115
Henry's Fork	175	130
Southern Idaho Tributaries	125	95
Big and Little Wood	140	110
Boise	130	100
Owyhee	130	90
Payette	145	105
Malheur	120	85
Weiser	145	100
Burnt	115	80
Powder	115	80
Salmon	150	100
Grande Ronde	115	80
Clearwater	130	100
LOWER COLUMBIA BASIN		
Yakima	88	90
Umatilla	76	78
John Day	92	82
Deschutes - Crooked	86	87
Hood	77	81
Willamette	85	87
Lewis	78	106
Cowlitz	97	101
PACIFIC COASTAL BASIN		
Puget Sound	100	97
Olympic Peninsula	113	104
Umpqua - Rogue	73	90
Klamath	94	93
Trinity	65	90
CALIFORNIA CENTRAL VALLEY		
Upper Sacramento	100	120
Feather	110	120
Yuba	110	110
American	110	110
Mokelumne	100	100
Stanislaus	95	100
Tuolumne	95	95
Merced	90	85
San Joaquin	115	110
Kings	100	110
Kaweah	100	100
Tule	90	80
Kern	160	135

Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.

Average is for 1948-62 period. California 1931-1960

Based on Selected Snow Courses determined by Distribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.

streams declined sharply during February because of an almost total lack of precipitation and mountain snowfall. Forecasts are now near average for Sacramento Valley and Central Sierra streams, with higher than average flow expected for the streams at the extreme southern end of the San Joaquin Valley.

MISSOURI BASIN

Snowmelt season runoff is expected to be well above average for all Missouri River tributaries in Montana except for the Milk River. Highest flows are anticipated from the Gallatin, the Yellowstone and tributaries from the Park area and the Sun and Teton Rivers northwest of Helena. Storage in the large upstream reservoirs tends to be below that of a year ago. However, storage in Fort Peck and the large reservoirs in the Dakotas is well above that for March 1, 1966. Some snowmelt runoff has already occurred in the plains area and at foothill elevations. Soil moisture conditions are relatively good.

Streamflow prospects take a substantial drop further south along the Continental Divide in northwestern Wyoming. Forecasts for the upper Wind River and for the Big Horn and Shoshone rivers in Powell Basin are for near average flows. Snowfall has been deficient on the Big Horn mountain range in north central Wyoming. Forecasts for streams both east and west of the Big Horns are for less than normal flows. This will result in water shortage along the smaller streams if late season precipitation is deficient.

Near average streamflow is in prospect for the North Platte serving southeastern Wyoming and western Nebraska. While reservoir storage is depleted to much below average levels, carryover storage and prospective streamflow should provide adequate water for irrigation. Storage in Seminoe and Pathfinder reservoirs is far below average.

Streamflow prospects improved slightly on the South Platte during February. Streamflow prospects range from 80 to 100 percent of average. Storage in smaller irrigation reservoirs and the Colorado-Big Thompson project is down from recent years. Unless snowfall is extremely deficient in March and April, storage and streamflow should provide enough water to meet normal demands. Storage in municipal reservoirs remains favorable.

ARKANSAS BASIN

Near average flows are expected on the main stem Arkansas in Colorado. Storage in both John Martin and smaller irrigation reservoirs is down substantially from the favorable storage situation of a year ago; but is near average. Overall, the water outlook is somewhat less favorable than the water supply in 1966.

Soil moisture in valley areas tends to be dry. This will place an additional stress on a limited water supply for early irrigation.

The flow of tributaries from the Sangre de Cristo range will be much less than average unless there is a major improvement in the next two months.

Snowfall on the headwaters of the Canadian in New Mexico is extremely deficient. Storage for the Tucumcari Project is down from a year ago, but will alleviate much of the prospective streamflow shortage in this area.

RIO GRANDE BASIN

Another poor year is in prospect for the Rio Grande, particularly for the major irrigated areas along the Rio Grande and Pecos in New Mexico. The only effective snowpack is along the Continental Divide in Colorado. Forecasts for streams from the Continental Divide range in Colorado into San Luis Valley are for about three-quarters of average flow. Prospective flows decline to about 50 percent or less for the Middle and Lower Rio Grande Irrigation Districts. El Vado Reservoir is empty and Elephant Butte storage is much less than average and a year ago. Soils are dry in irrigated areas.

COLORADO BASIN

Snow accumulation on the source area watersheds of the Colorado River Basin is near average for March 1. The total variation in snowpack is from about 90 percent on the San Juan to 110 percent on the Yampa in Colorado. Streamflow will be adequate to meet local needs along the major tributaries in the upper Basin.

Even with deficient snowfall during February, Uintah Basin streams in Utah are still forecast at about 120 percent of average. If the dry weather pattern persists, the smaller Colorado River tributaries in southern Utah will not have enough flow to meet demands for the coming irrigation season. Along with other areas of the southwest, February was an extremely dry month in southern and southeastern Utah.

Net inflow to Lake Powell is forecast at exactly average, (7,700,000 acre-feet), the same as for one month ago. The inflow prospect for 1967 is roughly one-third greater than for the April-July period in 1966. Storage in the larger reservoirs in the upper Colorado Basin including Lake Mead is now about 26,000,000 acre-feet, about one and one-half million acre-feet less than a year ago.

The Arizona snowpack is at a record low in most areas. The maximum snowpack was reached on January 1. It has declined steadily since that date. Usually snowfall reaches its max-

SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1967 as of MARCH 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
UPPER MISSOURI	1966	1967	
Jefferson at Sappington, Montana	331	1050	108
Madison near Grayling, Montana 1/	378	484	115
Gallatin near Gateway, Montana	389	570	127
Missouri near Zortman, Montana 2/		5100	113
Sun at Gibson Dam, Montana 3/	450	745	122
Marias near Shelby, Montana 4/	435	710	109
Milk near Eastern Crossing, Montana (Mar-Sept)	384	253	93
Yellowstone at Livingston, Montana	1628	2400	113
Shields at Clyde Park, Montana		112	113
Clark Fork at Chance, Montana	431	655	112
Shoshone, Inflow to Buffalo Bill Res., Wyo.		830	103
Wind at Dubois, Wyoming		102	102
Bull Lake near Lenore, Wyoming		168	95
Tensleep near Tensleep, Wyoming		68	95
Yellowstone at Miles City, Montana 5/		6400	110
Missouri near Williston, N. Dakota 6/		12000	109
PLATTE			
North Platte at Saratoga, Wyoming		705	110
Laramie near Jelm, Wyoming 7/		118	105
Clear at Golden, Colorado		125	93
St. Vrain at Lyons, Colorado		62	98
Cache LaPoudre near Fort Collins, Colorado 8/		200	81
ARKANSAS			
Arkansas at Salida, Colorado 9/		330	96
Purgatoire at Trinidad, Colorado		25	76
RIO GRANDE			
Rio Grande near Del Norte, Colorado 10/		375	76
Conejos near Mogote, Colorado 11/		158	81
Rio Chama near LaPuente, New Mexico		155	72
Rio Grande at Otowi Bridge, New Mexico 12/ (Mar-July)		325	55
Pecos at Pecos, New Mexico *		20	38
UPPER COLORADO			
Colorado near Granby, Colorado 13/		250	107
Colorado near Glenwood Springs, Colorado 14/		1600	103
Roaring Fork at Glenwood Springs, Colorado 15/		850	112
Gunnison at Grand Junction, Colorado		1260	97
Dolores at Dolores, Colorado		245	94
Colorado near Cisco, Utah		4100	108
Green below Flaming Gorge Res., Utah 16/ (Apr-July)		1130	100
Yampa at Steamboat Springs, Colorado		315	108
White at Meeker, Colorado		300	90
Duchesne near Tabiona, Utah 17/		125	110
Rock Creek near Mountain Home, Utah		107	105
Price near Scofield, Utah 18/		42	114
Green at Green River, Utah 16/		3400	101
San Juan near Rosa, New Mexico		500	84
Animas at Durango, Colorado		410	90
San Juan near Bluff, Utah 19/		950	81
Colorado, Inflow to Lake Powell, Arizona 20/ (Apr-July)		7700	100
LOWER COLORADO			
Gila near Solomon, Arizona (Mar-May)	228	19	25
Salt at Intake, Arizona (Mar-May)	484	55	24
Verde above Horseshoe Dam, Arizona (Mar-May)	91	60	53

SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1967 as of MARCH 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
GREAT BASIN	1966	1967	
Bear at Harer, Idaho	208	290	112
Logan near Logan, Utah 21/		130	98
Ogden, Inflow to Pine View Res., Utah 22/		110	85
Weber near Oakley, Utah		125	102
Inflow to Utah Lake, Utah		290	103
Big Cottonwood near Salt Lake City, Utah		38	97
Beaver near Beaver, Utah		20	82
South Fork Humboldt near Elko, Nevada **		46	77
Humboldt at Palisades, Nevada **		115	66
Truckee at Farad, California 25/**		310	115
East Carson near Gardnerville, Nevada **		224	125
West Walker near Coleville, California **		175	125
UPPER COLUMBIA			
Columbia at Revelstoke, British Columbia			
Kootenai at Wardner, British Columbia			
Kootenai at Leonia, Idaho	9176	11020	118
Flathead near Columbia Falls, Montana 26/	5670	7400	122
Flathead near Polson, Montana 26/	6841	9400	121
Clark Fork above Missoula, Montana	1203	1990	108
Bitterroot near Darby, Montana	273	595	102
Clark Fork at Whitehorse Rapids, Montana 26/	11474	16170	112
Columbia at Birchbank, British Columbia 26/	45500	54000	120
Spokane at Post Falls, Idaho 27/		3200	94
Columbia at Grand Coulee, Washington 26/	62500	81000	115
Okanogan near Tonasket, Washington		1920	98
Chelan at Chelan, Washington 28/		1310	91
Wenatchee at Peshastin, Washington		1870	97
SNAKE			
Snake above Palisades Res., Wyoming 29/		2650	102
Snake near Heise, Idaho 29/		3800	98
Henry's Fork near Rexburg, Idaho 30/		1380	110
Big Lost near Mackay, Idaho 31/		180	118
Big Wood, Inflow to Magic Res., Idaho 32/		340	107
Bruneau near Hot Springs, Idaho		160	74
Owyhee Res., Net Inflow, Oregon (Mar-July)		369	79
Boise near Boise, Idaho 33/		1600	98
Malheur near Drewsey, Oregon (Mar-July)		96	90
Payette near Horseshoe Bend, Idaho 34/		2000	101
Snake at Weiser, Idaho		5900	85
Salmon at Whitebird, Idaho		7100	101
Clearwater at Spalding, Idaho		9700	105
LOWER COLUMBIA			
Grande Ronde at LaGrande, Oregon (Mar-July)		208	84
Yakima at Cle Elum, Washington 35/		950	91
Deschutes at Benham Falls, Oregon 36/ (Apr-July)		400	96
Columbia at The Dalles, Oregon 26/	87000	118000	109
Hood near Hood River, Oregon 36/		288	75
Willamette at Salem, Oregon 36/		4600	83
Lewis at Ariel, Washington 37/		1380	95
Cowlitz at Castle Rock, Washington		2840	96

Forecasts in California provided by Department of Water Resources.
Average is for 1948-62 period except California. California is computed for
Forecasts assume average Effective Climatic Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts Listed on Inside Back Cover.
** April - June Period ** April - July Period*

SELECTED STREAMFLOW FORECASTS APRIL-SEPTEMBER 1967 as of MARCH 1, 1967

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW	FORECAST	
	1966	1967	
NORTH PACIFIC COASTAL			
Dungeness near Sequim, Washington	--	178	100
Rogue at Raygold, Oregon	--	814	80
Klamath Lake, Net Inflow, Oregon (Mar-June)	--	687	102
CALIFORNIA CENTRAL VALLEY 38/**			
Sacramento, Inflow to Shasta, California	1598	1840	103
Feather near Oroville, California	1324	1970	101
Yuba at Smartville, California	770	1150	102
American, Inflow to Folsom Res., Calif.	761	1300	94
Cosumnes at Michigan Bar, California	54	130	99
Mokelumne, Inflow to Pardee Res., Calif.	286	460	96
Stanislaus, Inflow to Melones Res., Calif.	463	680	92
Tuolumne, Inflow to Don Pedro Res., Calif.	767	1100	91
Merced, Inflow to Exchequer Res., Calif.	387	500	80
San Joaquin, Inflow to Millerton Lake, Calif.	837	1200	99
Kings, Inflow to Pine Flat Res., California	825	1270	108
Kaweah, Inflow to Terminus Res., California	149	330	125
Tule, Inflow to Success Res., California	13	60	107
Kern, Near Bakersfield, California	220	580	134

Forecasts in California provided by Department of Water Resources.
Average is for 1948-62 period except California. California is computed for 1911-60
Forecasts assume average Effective Climate Conditions from Date Through Snow Melt Season.

Explanatory Notes on Forecasts listed on Inside Back Cover.
** April - June Period ** April - July Period*

imum about March 1. January and February precipitation was far below normal all over the state.

Earlier season forecasts have been reduced. With average effective, climatic conditions through May, the March-May 1967 runoff in the Salt, Gila and San Francisco Rivers is expected to be about 25 percent of average and 50 percent on the Verde.

As a result of heavy runoff last year, the major reservoirs contain two to four times their average stored water for this date. This storage varies from twice average and 79 percent of capacity on the Salt River Project to four times average and 25 percent of capacity for San Carlos Reservoir on the Gila.

Water supplies will be adequate where storage facilities are available. Areas depending on direct diversion will be short of water and heavy, supplemental pumping will be required.

GREAT BASIN

Prospects for next summer's snowmelt streamflow are still relatively good in the Utah portion of the Great Basin. Although February was warm and dry, the early season snowpack was favorable. Forecasts have been reduced slightly for the Salt Lake Basin and up to 40 percent in central and southern Utah. Most streams are expected to yield between 80 percent and 120 percent of average flow amounts. Exceptions are the main and east forks of the Sevier River south of Piute Reservoir and the Little Bear in Cache Valley where runoff in the 65 percent to 80 percent range is expected. Reservoir storage is slightly above average except for Sevier and Beaver River Reservoirs where it is only 60 percent of average. If warm, dry conditions prevail during March, some shortages will be experienced in those areas with below average stored water supplies.

East slope Sierra streams flowing into the west central Nevada portion of the Great Basin are expected to have moderately above average streamflow during the 1967 irrigation season. April-July streamflow is predicted in the 115 to 125 percent of average range on the Tahoe-Truckee, Carson and Walker rivers. The March 1 snowpack in this area is 115 to 120 percent of average with the largest percent of average snow at the higher elevations.

Reservoir storage is 109 percent of the March 1 average and is 58 percent of capacity.

Mountain soil moisture conditions are good.

The water supply outlook in the Humboldt basin decreased during February due to below average snowfall. Humboldt at Palisades is now expected to flow 66 percent of its April-July average; a drop of 9 percent from the outlook of one month ago. Tributaries to the main Humboldt are expected to have flows during the snowmelt season ranging from 60 percent of average to a high of 96 percent on Lamoille Creek in the Rubys.

COLUMBIA BASIN

Due primarily to heavy early winter storms, the snow water accumulation to date ranges from 80 percent to 140 percent in the major sub-basins of the Columbia basin. The heaviest snowpack is in British Columbia and northwestern Montana where snow water equivalent at some high mountain snow courses exceeds or approaches the maximum of record for any date in the past 25 years. In general, February snowfall throughout the basin was below normal and temperatures, particularly at the median and valley elevations, were unseasonably high. The present outlook is for 109 percent of average April-September flow for the Columbia at The Dalles, Oregon.

The British Columbia Water Resources Service reports that mountain snowpack is above to well above average throughout the Province with the heaviest concentrations of the above average snow lying at the higher mountain elevations. Many snow courses have recorded the highest March 1 measurement in their periods of record especially on the main stem Columbia and Upper Fraser watersheds. Volume streamflow during the spring and summer runoff period is expected to be above to well above average on the major rivers of the Province.

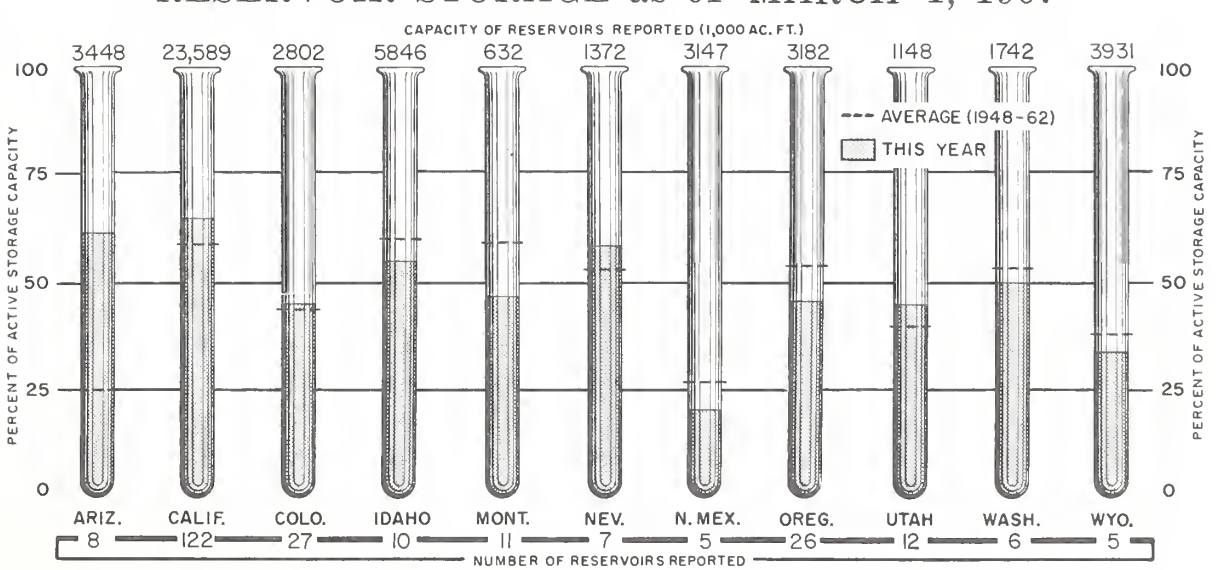
The high elevations in the Mission and Whitefish Ranges in Montana, and up to the headwaters of the Kootenai, have a record snowpack. Near record snow accumulation was recorded in the high elevations of the Flathead drainage. The median elevations in the Kootenai and Flathead have above average snowpack, while low elevations are near to below average. The Bitterroot and Clark Fork drainages have near average snowpack. In these drainages the high elevation accumulation is above average, while low elevations are near or a little below average. The snowpack is extremely dense for this time of the season.

Seasonal streamflow volume is forecast to be second highest on record on the main stem of the Kootenai River as it enters Montana. Runoff from streams tributary to the Kootenai in Montana are forecast above average but not near the record flow. This less than record inflow reduces forecasts on the main stem at Leonia to the fifth highest on record.

Streamflow on the Flathead drainages is forecast third to fifth highest on record. The Swan River is forecast second highest on record.

The water supply outlook for Idaho dropped slightly during the month of February as a result of light snowfall and unusually warm temperatures. Water supply forecasts now vary from 67 percent of normal for Inflow to Oakley Reservoir to 125 percent on the Little Wood River above High Five Creek. The forecasts for major rivers throughout the state including the Spokane, Snake, Boise, Payette, Salmon and Clearwater are all very close to average.

RESERVOIR STORAGE as of MARCH 1, 1967



STORAGE IN LARGE RESERVOIRS MARCH 1, 1967

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER MISSOURI		
Boysen	952	573
Buffalo Bill	380	156
Canyon Ferry	2043	1166
Hebgen	377	170
Tiber	1316	471
Yellowtail	1356	652
Belle Fourche	185	100
Keyhole	190	112
Fort Peck	19410	16516
Fort Randall	5800	3883
Garrison	24500	16047
Oahe	23600	15072
Big Bend	1900	1724
PLATTE		
Glendo	786	352
Pathfinder	1011	210
Seminoe	982	121
City of Denver (5)	578	402
Colo-Big Thompson (4)	865	308
ARKANSAS		
Conchas	280	191
John Martin	367	188
RIO GRANDE		
Elephant Butte	2207	352
El Vado	194	1
UPPER COLORADO		
Flaming Gorge	3789	2096
Navajo	1709	374
Powell	28040	7525
Blue Mesa		372
LOWER COLORADO		
Havusu	619	532
Mead	27207	15617
Mohave	1810	1662
San Carlos	1206	305
Salt River Res. (4)	1755	1476
Verde River Res. (2)	323	158
GREAT BASIN		
Bear	1421	1076
Lahontan	286	208
Rye Patch	179	73
Sevier Bridge	236	37
Strawberry	265	95
Tahoe	732	444
Utah	1149	653

BASIN AND NAME OF RESERVOIR	CAPACITY (1000 A.F.)	STORAGE (1000 A.F.)
UPPER COLUMBIA		
Chelan	676	178
Coeur d'Alene	238	121
Flathead	1791	1049
Hungry Horse	2982	1746
Kootenay	673	197
Pend Oreille	1155	698
Roosevelt	5232	3193
LOWER COLUMBIA		
Cougar	155	40
Detroit	300	91
Hills Creek	200	58
Lookout Point	337	98
Yakima Res. (5)	1066	704
SNAKE		
American Falls	1700	1378
Arrowrock	287	189
Anderson Ranch	423	153
Brownlee	1426	918
Cascade	653	109
Jackson	847	505
Lucky Peak	278	32
Palisades	1202	523
Owyhee	715	363
PACIFIC COASTAL		
Cachuma	205	206
Casitas	254	110
Clair Engle	2500	2007
Clear Lake	440	192
Nacimiento	350	205
Ross	1203	1022
Upper Klamath	584	349
CALIFORNIA CENTRAL VALLEY		
Almanor	1036	658
Berryessa	1602	1617
Camanche	432	208
Don Pedro	290	159
Folson	1010	570
Hetch-Hetchy	360	109
Isabella	570	254
McClure	1026	496
Millerton	521	410
Pine Flat	1013	706
Shasta	4500	3351

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.

The high elevation snow courses on many rivers have a snowpack slightly above normal. At the middle and lower elevations in the mountainous areas, where substantial snowmelt has already occurred, the snowpack falls well below normal, particularly on those rivers south of the Snake River. Water supply shortages can be expected on Salmon Falls Creek and Oakley Reservoir areas as well as all of the adjacent small streams.

Valley soils are drying out rapidly and may require an early irrigation which would adversely affect the water supply outlook on all rivers of the state. Soil moisture beneath the snowpack at high elevations is well below normal and will absorb a considerable amount of snow water once the major melt begins. Reservoir storage still remains below normal.

Tributaries to the Columbia River heading in the Washington Cascades have a snowpack which ranges from 91 percent to 117 percent of the March 1 average. The February 1 pattern of above average snow above 4500 feet and poor to nonexistent at lower elevations still prevails. Reservoir storage is near average. April-September streamflow forecasts for the Spokane, Okanogan, Chelan, Wenatchee, Yakima, Lewis and Cowlitz Rivers falls in the 90 percent to 100 percent category.

Spring and summer 1967 water supplies in Oregon will be slightly below average. Deficient February precipitation and reduced snowfall has dimmed the picture of late-season water supplies. On the bright side, watershed soils are well recharged and stored water supplies are mostly satisfactory.

Precipitation in February was very deficient but total winter precipitation has been above average except in the Willamette and Hood-Wasco areas.

Water content of the mountain snowpack on March first is about 85 percent of average with the poorest snow cover in the northeastern and north central portions of the state.

Water stored in 26 reservoirs, used primarily for irrigation, adds up to 1,724,000 acre-feet or 92 percent average for this date, 83 percent of March 1, 1966.

Most reservoirs will have sufficient water for the 1967 season but both Wallowa Lake and McKay reservoirs in northeastern Oregon will furnish only a partial supply this season. Forecasts of streamflow for the spring and summer of 1967 range from 75-90 percent of average with Hood River and White River in the Hood-Wasco county area expected to produce only 75 percent of the 15-year average (1948-62).

ALASKA

Near normal snow cover exists in the major portion of interior Alaska. Slightly more than average is reported on the upper Tanana, Copper and Matanuska watersheds with slightly less than average on the Susitna basin.

Heavy snowfall fell on the mountains of southeast Alaska during the months of January now greater than last year at this time.

Extremely light precipitation last summer and fall left the soils very dry in most of the area north of the Alaska Range. Although near normal snow cover exists, it is expected that the dry soil will absorb a considerable portion of the water when snowmelt begins.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting in California, reports that a dry February - the fourth in as many years - has had a general normalizing effect on factors contributing to California's water supply. The snowpack in Upper Sierra and Cascade watersheds generally retained the water content accumulated in December and January and consequently is slightly above normal for March 1. By considering all factors and assuming normal precipitation during the remainder of the season, the outlook is for near normal water supply in most areas of California during the coming spring and summer months.

Precipitation in California during February was only 10 percent of normal, making it one of the driest Februarys on record. Two very mild storms made slight contributions to precipitation totals in regions north of the Tehachapi mountains. The Smith River Basin in the north coastal area, and the Tule River Basin in the San Joaquin Valley has received 25 percent of average for the month - higher with respect to normal than other river basins in the State.

Above normal temperatures were experienced over most of the State with positive departures -- averaging 5 degrees or more for the entire month -- being observed in the mountain areas. While this caused considerable melting of the low elevation snowpack, its effect at higher elevations was insignificant.

The dry February, a month that normally produces a large part of the year's water crop, lowered the season's-to-date precipitation to 115 percent of normal. Seasonal totals of rainfall in all areas, excluding the desert area, are above normal. Reflecting the pattern of the December and January storms, the distribution ranged from 105 percent of normal in the north coastal area

to 125 percent of normal in the south coastal area.

The drought conditions of the past month resulted in significant lowering of forecasts of the spring runoff for central valley streams. Even so, if precipitation is normal for the remainder of the season, runoff in the central valley during the April-July period will be about average. Forecasts for individual drainages vary from 80 percent of normal for the Merced river basin in the Central Sierras to 134 percent of normal for the Kern river basin in the extreme southern Sierra.

Unimpaired runoff of California's major streams during February was about normal. In January, the runoff from snow-fed streams was average or above but in coastal streams it was only 50 percent of normal.

Based on March 1 storage, values from 122 reservoirs which have a capacity of over 23,500,000 acre-feet, the aggregate storage in California reservoirs was about 110 percent of average. This represents a net increase of about 900,000 acre-feet of water storage over that reported one year ago.

EXPLANATION of STREAMFLOW FORECASTS

All flows are observed flows except as adjusted for: 1/ Change in storage in Hebgen Lake. 2/ Change in storage in Canyon Ferry and Tiber reservoirs. 3/ Change in storage in Gibson Reservoir and measured diversions. 4/ Change in storage in Two Medicine, Four Horns and Lake Francis reservoirs. 5/ Change in storage in Boysen and Buffalo Bill reservoirs.

6/ Change in storage in Boysen, Buffalo Bill, Canyon Ferry, Tiber, and Fort Peck reservoirs. 7/ Plus diversions to Cache la Poudre. 8/ Minus diversions from North Platte, Laramie, and Colorado rivers plus measured diversions above station. 9/ Change in storage in Twin Lakes and Sugar Loaf reservoirs minus diversions from Colorado River.

10/ Change in storage in Rio Grande, Santa Maria, and Continental reservoirs. 11/ Change in storage in Platoro Reservoir. 12/ Change in storage in El Vado Reservoir. 13/ Change in storage in Granby Reservoir plus diversions to Cache la Poudre and through Adams Tunnel. 14/ Changes as indicated in (13) plus Moffatt Tunnel diversion. 15/ Plus diversions to Arkansas River.

16/ Change in storage in Flaming Gorge and Big Sandy reservoirs. 17/ Plus diversion through Duchesne Tunnel. 18/ Change in storage in Scofield Reservoir. 19/ Change in storage in Navajo Reservoir. 20/ (Lee's Ferry) Change in storage in Flaming Gorge, Navajo, Lake Powell, and Big Sandy reservoirs.

21/ Plus Utah Power and Light Company tailrace and Logan, Hyde Park, and Smithfield canals. 22/ (Inflow record computed by U. S. Bureau of Reclamation.) 23/ Plus diversion by Weber-Provo Canal and change in storage in Wanship Reservoir. 24/ Change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake City Aqueduct. 25/ Change of storage in Lake Tahoe and Boca Reservoir. (Forecast by Truckee Basin Committee)

26/ Change in storage in any of these reservoirs above the station: Kootenai Lake, Hungry Horse, Flathead Lake, Pend Oreille Lake, F. D. Roosevelt Lake, Lake Chelan, Coeur d'Alene Lake, Brownlee and Noxon; and pumpage at Roosevelt Lake. 27/ Changes in storage in Coeur d'Alene Lake and diversions by Spokane Valley Farms Company and Rathdrum Prairie canals. 28/ Change in storage in Lake Chelan. 29/ Changes in storage for Jackson Lake and Palisades Reservoir above stations. 30/ Change in storage in Henry's Lake, Island Park and Grassy Lake reservoirs and diversions between Ashton and Rexburg.

31/ Change in storage in Mackay Reservoir, and diversion in Sharp Ditch. 32/ (Combined flow Big Wood River nr. Bellevue and Camas Creek nr. Blaine.) 33/ Change in storage in Arrowrock, Anderson Ranch, and Lucky Peak. 34/ Change in storage in Cascade and Deadwood reservoirs. 35/ Change in storage in Keechelus, Kachess, and Cle Elum reservoirs plus diversion by Kittitas Canal. 36/ (Corrected to natural flow). 37/ Change in storage in Merwin, Yale, and Swift reservoirs. 38/ (Corrected for upstream impairments).

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